



# National Institute of Standards & Technology

## Certificate

### Standard Reference Material<sup>®</sup> 2218

#### Miniaturized High-Energy Charpy V-Notch KLST Impact Specimen

#### Verification Specimen for Small-Scale Instrumented Charpy Impact Machines

Lot No. HH-103

This Standard Reference Material (SRM) is intended for the verification of maximum force and absorbed energy values measured at room temperature using a small-scale Charpy impact machine in accordance with the current standards ASTM E2248 [1] or ISO 14556, Annex D [2]. A unit of SRM 2218 consists of a set of three KLST-type specimens needed to perform a single verification. SRM 2218 can be used to verify the absorbed energy scale of the small-scale impact machine at the high energy level (approximately 5.7 J).

**SRM Certification Procedure:** Specimens taken from SRM 2218 were certified for both maximum force ( $F_m$ ) and absorbed energy (KV) by means of an international interlaboratory comparison (Round-Robin) coordinated by the NIST Applied Chemicals and Materials Division [3]. The Round-Robin results were statistically evaluated in collaboration with the NIST Statistical Engineering Division to assure consistency among laboratories and establish certified values. The certified values determined for the SRM 2218 specimens are given in Table 1 following the verification test (see “Instructions for Handling, Storage, and Use”) and are valid in the temperature range of  $21\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ . The KV is defined as the energy required to break a miniaturized V-notched specimen of standardized dimensions, defined in either ASTM 2248 or ISO 14556. The certified values are estimated as the mean of means of absorbed energies measured on the nine pendulums that participated in the round robin. The pendulums used are regularly verified with equipment that is calibrated in a manner that is traceable to the International System of Units (SI). Therefore, the certified values are traceable to the SI unit joule.

Table 1. Certified Absorbed Energy (KV) Values and Certified Maximum Force ( $F_m$ ) Values for SRM 2218<sup>(a)</sup>

Absorbed Energy, KV (J)	Expanded Uncertainty <sup>(b)</sup> (J)	Maximum Force, $F_m$ (kN)	Expanded Uncertainty <sup>(b)</sup> (kN)
5.65	0.10	1.78	0.08

<sup>(a)</sup> Test Temperature:  $21\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ .

<sup>(b)</sup> The uncertainty in the certified value is expressed as an expanded uncertainty,  $U = ku_c$ , where  $u_c$  is the standard uncertainty. The coverage factor,  $k = 2.306$ , is determined from the Student's t-distribution corresponding to eight degrees of freedom and a 95 % confidence level [4,5].

**Expiration of Certification:** The indirect verification result for the absorbed energy scale is valid for one year from the date that the SRM was tested. If a user's machine is moved or undergoes any major repairs or adjustments, the current verification will be invalidated, and the machine must be retested and verified (see “Instructions for Handling, Storage, and Use”). Currently there are no requirements for the indirect verification of the force scale. However, it is recommended to verify the calibration of the instrumented striker of the small-scale Charpy machine every time the striker undergoes repairs or adjustment, or damage is suspected, and every time the impact machine is indirectly verified for absorbed energy.

Overall direction and coordination of the technical measurements leading to verification of test specimens and machines, evaluation of test results, and issuance of the report on machine conformance are under the direction of the NIST Applied Chemicals and Materials Division, Boulder, CO.

Stephanie Hooker, Chief  
Applied Chemicals and Materials Division

Gaithersburg, MD 20899  
Certificate Issue Date: 19 March 2014

Robert L. Watters, Jr., Director  
Office of Reference Materials

**Maintenance of SRM Certified Values:** NIST will monitor the conditions under which this SRM was certified and, if substantive changes occur, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Office of Reference Materials.

## INSTRUCTIONS FOR HANDLING, STORAGE, AND USE

**Handling:** The protective oil coating should be wiped from each specimen just prior to testing.

**Storage:** The SRM is anticipated to have an indefinite shelf life under normal storage conditions.

**Use:** Prior to verifying a small-scale Charpy V-Notch machine, the machine should be checked to assure compliance with the appropriate sections of the applicable ASTM or ISO standard. SRM 2218 is tested at  $21\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$  so that both the absorbed energy scale and force scale can be verified in accordance with the applicable standard (ASTM or ISO). The energy level of the SRM appropriate for verifying the performance of a particular small-scale Charpy impact machine can be determined by considering the energy for the SRM, the maximum capacity of the machine, and the requirements of the applicable test method (ASTM or ISO).

**Material Description:** SRM 2218 is made from 4340 alloy steel. Each specimen has a code identifying the energy level (HH) and an identification number (one, two or three digits) stamped on two sides.

For questions concerning the production or use of this SRM, please contact the NIST Charpy Program Coordinator: telephone (303) 497-3351; fax (303) 497-5939; or e-mail [charpy@boulder.nist.gov](mailto:charpy@boulder.nist.gov).

## REFERENCES

- [1] ASTM E2248, *Test Method for Impact Testing of Miniaturized Charpy V-Notch Specimens*; Annual Book of ASTM Standards, 03.01, ASTM, West Conshohocken, PA.
- [2] ISO 14556, *Steel – Charpy V-notch pendulum impact test – Instrumented test method*; ISO, Geneva, Switzerland.
- [3] Lucon, E.; McCowan, C.; Santoyo, R.; Splett, J.; *Certification Report for SRM 2216, 2218, 2219: KLST (Miniaturized) Charpy V-Notch Impact Systems*; NIST Special Publication 260-180 (2013); available at <http://www.nist.gov/srm/publications.cfm> (accessed Mar 2014).
- [4] JCGM 100:2008; *Evaluation of Measurement Data - Guide to the Expression of Uncertainty in Measurement*; (GUM 1995 with Minor Corrections), Joint Committee for Guides in Metrology (2008); available at [http://www.bipm.org/utls/common/documents/jcgm/JCGM\\_100\\_2008\\_E.pdf](http://www.bipm.org/utls/common/documents/jcgm/JCGM_100_2008_E.pdf) (accessed Mar 2014); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297; U.S. Government Printing Office: Washington, DC (1994); available at <http://www.nist.gov/pml/pubs/index.cfm> (accessed Mar 2014).
- [5] JCGM 101:2008; *Evaluation of Measurement Data – Supplement 1 to the “Guide to the Expression of Uncertainty in Measurement” - Propagation of Distributions using a Monte Carlo Method*; JCGM (2008); available at [http://www.bipm.org/utls/common/documents/jcgm/JCGM\\_101\\_2008\\_E.pdf](http://www.bipm.org/utls/common/documents/jcgm/JCGM_101_2008_E.pdf) (accessed Mar 2014).

*Users of this SRM should ensure that the Certificate in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail [srminfo@nist.gov](mailto:srminfo@nist.gov); or via the Internet at <http://www.nist.gov/srm>.*